VESDA-E VEA

Engineering Specification

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Contents

1 Scope

This document provides specification details of the VESDA-E VEA Air sampling Smoke Detection (ASD) products to assist in their specification.

2 System Information

2.1 General

1. An early warning addressable ASD smoke detection system similar to the VESDA-E VEA shall be installed throughout the areas nominated on the drawings.
2. The ASD system shall incorporate addressable microbore sampling tubes and pinpoint locations from where the smoke events are reported.
3. The system shall incorporate high capacity pumps to actively sample air from the protected area into the housing where highly sensitive short wavelength laser-based smoke sensor module is located to analyze the sample air.
4. The system shall be connected to a network of microbore air sampling tubes, when required an optional display unit shall be provided to monitor each detector.
5. The system will consist of a central housing with 40 microbore sampling tubes that are routed to the protected area with capacity to expand up to 120 microbore sampling tubes.
6. The system shall support maximum microbore tube length of 100m (328ft) per tube, however shorter tube lengths may be used as per the manufacturer's guidelines.
7. The system shall incorporate end to end tube integrity and sample point integrity monitoring
8. The system shall incorporate centralized smoke test and maintenance facilities to ensure the proper operation of the smoke sensor module and other system components.

2.2 Approvals

The Early Warning Smoke Detection System must be of a type submitted to, tested, approved, and/or listed by one or more of Nationally Recognized Testing Laboratory (NRTL) as follows:

- UL (Underwriters Laboratories Inc, USA)
- ULC (Underwriters Laboratories Canada)
- FM (Factory Mutual), and FM approved for Hazardous Locations
- Class 1, Div.2, Groups A, B, C, D (3020906), USA
- CSFM (California State Fire Marshall, USA)
- LPCB (Loss Prevention Certification Board), UK
- ActivFire, Australia
- VdS (Verband der Sachversicherer e. V.), Germany
- AFNOR, France
- VNIIPO, Russia
- CFE, China
- KFI, Korea

When used within the EU, the system shall be declared to the Construction Products Regulation (EU) 305/2011 by a notified body such as VdS / LPCB when tested to the EN54-20 standard.

2.3 Codes, Standards or Regulations

The VEA smoke detector shall be installed to comply with local codes and standards or one or more of the following codes or standards:

1. AS 1670.1, AS1603.8, ASNZS 3000 – latest editions
2. Fire Industry Association (FIA), Code of Practice for Design, Installation, Commissioning and Maintenance of Aspirating Smoke Detector (ASD) Systems
3. NFPA Standards, US
4. NEC Standards, US
5. NZS 4512 : 2003

2.4 Quality Assurance

2.4.1 Manufacturer

The manufacturer shall have a minimum of 35 years production experience in the design and manufacture of high sensitivity air sampling smoke detection systems.

The manufacturer shall be certified as meeting ISO 9001:2008 for manufacturing.

2.4.2 Equipment Supplier

The equipment supplier shall be trained by the manufacturer to calculate/design, install, test and maintain the air sampling system and shall be able to produce a certificate stating such on request.

2.5 Documentation

The following documentation shall be supplied:

1. Product data and site drawings shall be submitted and shall include pipe layout, operational calculations and performance criteria. Tools such as AutoCAD may be used to generate this material.
2. A copy of the manufacturer’s installation, operation and maintenance manuals shall be supplied upon completion of the installation.
3. System commissioning data shall be supplied in a format recommended by the manufacturer and per the instructions provided by the manufacturer.

3 System Description

3.1 System Features

The system shall:

1. Consist of highly sensitive, short wavelength LASER-based and light scattering smoke detectors, microbore sampling tubes, rotary valve, pumps, and filters.
2. Be modular, with:
   - base detectors and stack modules each accommodating up to 40 addressable microbore sampling tubes where each tube has a sampling point at the end
   - each base detector capable of supporting up to two stacks providing up to 120 addressable sampling holes per system
   - each base detector having a display with indicator LEDs and a reset button
   - optionally each base having an LCD Display showing detector status including fault categories and smoke level relative to the fire alarm setting
3. Each base detector and stack module contain at least two smoke detection chambers
4. Consist of a microbore air sampling tube network to transport air to the detection system.
5. Be approved to provide Early Warning Smoke Detection (EWSD) and provide four output levels corresponding to Alert, Action, Fire 1 and Fire 2. These levels shall be settable to sensitivities corresponding to Very Early Warning Fire Detection (VEWFD) / Early Warning Fire Detection (EWFD) / Standard Fire Detection (SFD) as defined in NFPA76 or Class A / Class B / Class C as defined in EN54-20.
6. First generate a common detector alarm condition for the above four alarm levels and then generate a Fire-1 alarm identifying the addresses of microbore sampling tubes to pinpoint the exact locations of where the alarms are generated.
7. Support optional equipment which may include intelligent remote displays and/or a high level interface with the building fire alarm system, or a dedicated graphics package such as Xtralis VSM.
8. Be tested to cover 2,000m^2 (20,000 sq.ft) protection area.
9. Implement tube integrity and sampling point integrity monitoring.
10. Be able to detect a single hole blockage where one sampling hole corresponds to one microbore sampling tube.
11. Have a facility to perform centralized smoke testing.
12. Have a facility to perform microbore sampling tube and sampling point cleaning.
13. Report any fault on the detector by using configurable fault relay outputs, via a peer-to-peer network or by communications to a monitoring software tool running on a PC or hand-held device such as a tablet or smart phone.
14. Be self-monitoring for filter contamination.

3.2 Detection Method

The detection sensing method shall use a laser light source and at least one photodiode spaced inside the detection chamber to detect smoke particles.

A particle counting method shall be employed for the purposes of:

1. Minimizing the effect of large dust particles on the true smoke obscuration.
2. Monitoring contamination of the filter (dust and dirt etc.) to automatically notify when maintenance is required.

3.2.1 Absolute Calibration

The detection chamber shall be factory calibrated and shall not use adaptive algorithms or drift compensation techniques to adjust the sensitivity or detector output from that established during commissioning.

4 Products

4.1 Manufacturer

Air Sampling Smoke Detection System: Acceptable Manufacturer.

Xtralis
4 North Drive
236 – 262 East Boundary Road
East Bentleigh VIC 3165
Australia
Telephone: +61 3 9936 7000
Fax: +61 3 9936 7200

4.2 Manufactured Units(s)

The VESDA-E VEA ASD system can be supplied in the following configurations:

Part Number	Description
VEA-040-A00	VESDA-E VEA-40 Aspirating Smoke Detector with LEDs
VEA-040-A10	VESDA-E VEA-40 Aspirating Smoke Detector with 3.5" Display
VEA-020-STX	VESDA-E VEA-20 Expansion StaX
VEA-040-STX	VESDA-E VEA-40 Expansion StaX
VER-A40-40-STX	VESDA-E VEA 40-Relay Local StaX
VSP-980	VESDA-E VEA Standard Sampling Point for 6mm Tube
VSP-981	VESDA-E VEA Standard Sampling Point for 4mm Tube

4.3 Detector Features

The detector shall incorporate the following features.

1. The Smoke Detectors, Filters, Pump and Relay Outputs shall be housed in a mounting box and shall be arranged in such a way that air is drawn from the fire risk area by a pump and a sample passed through a sample filter and detection chambers.
2. The detector shall employ a LASER light source and a photo diode.
3. The detector smoke sensor module shall have an obscuration sensitivity range of 0.02%-16% obs/m (0.0061–4.88% obs/ft).
4. The detector shall have three possible settings for Fire-1 at the sampling point; VEWFD / Class A (High) – 1.63% obs/m / 0.5% obs/ft), EWFD / Class B (Enhanced) - 4% obs/m / 1.22% obs/ft and SFD / Class C (Standard) - 8% obs/m / 2.44% obs/ft.
5. The detector shall have two pre-alarm smoke alarm thresholds with adjustable Alert threshold set to a % of Fire-1 threshold and Action threshold set in the middle of Alert and Fire-1 thresholds.
6. The detector shall have one Fire 2 threshold set to twice Fire 1.
7. The detector shall have adjustable time delays common for all thresholds between 0-60 seconds.
8. The detector shall have day and night thresholds selectable as one of three settings.
9. The detector shall employ modular construction allowing field replacement of the filter, detector module, pump and the rotary valve.
10. The detector shall allow future hardware expansion via stackable modules placed either on top or below or side of the detector.
11. The detector shall also incorporate facilities to transmit the following fault categories:

- Detector
- Air flow
- Filter
- System
- Zone
- Network
- Power
- Chamber
- Module

12. The detector shall support the generation and transmission of urgent and minor faults. Minor faults shall be considered as service or maintenance signals. Urgent faults indicate the unit may not be able to detect smoke.
13. The detector shall have 40 microbore sampling tube inlets and must contain a dual flow measurement arrangement using RTD and pressure sensors.
14. The filter shall be a disposable filter element and shall be capable of filtering particles in excess of 20 microns from the air sample.
15. A second filter shall be ultrafine, removing more than 99% of contaminant particles of 0.3microns or larger, to provide a clean air barrier around the detector's optics to prevent contamination and increase service life.
16. The pump shall be capable of allowing for multiple microbore sampling tube runs up to 100m (328ft) each with a transport time per applicable local codes.
17. The detector must contain relays for alarm and fault conditions. The relays shall be software programmable to the required functions. The relays must be rated at 2 Amp at 30 VDC. Additional local and remote relays shall be offered as an option and either configured to replicate those on the detector and / or programmed to provide an alarm relay output for each of the sampling tube representing a sampling hole.
18. The detector shall have built-in event and alarm condition logging. It shall store all alarm levels (Alert, Action, Fire 1, Fire 2) for the detector and each sampling tube, operator actions and faults. The date and time of each event shall be recorded. Each detector (zone) shall be capable of storing up to 20,000 events and shall not require the presence of a display in order to do so.
19. The detector shall incorporate a galvanically isolated General Purpose Input (GPI) which activates in the event of an applied voltage of 5 to 50VDC and can be assigned by configuration to activate one of several functions (Reset, Disable, Reset/Disable, Stand-by, Mains OK).
20. The detector shall incorporate a monitored voltage-free input, to be used with isolated relay contacts, which is supervised using a 10k Ohm terminating resistor.
21. The detector shall have seven or more relays for remote indication of alarms, fault and other status. The assignment of relay functions shall be configurable.

4.4 Displays

When required, a detector display module may be located within the detector, a remote mounting box or a 19 inch remote rack.

Each Display shall provide the following features at a minimum:

1. Color LCD touch screen user interface
2. A bar graph display.
3. Four independent high intensity alarm indicators, Alert, Action, Fire 1 and Fire 2, which correspond to the four alarm thresholds of the detector.
4. Fault icons indicating fault categories: detector, detection module, filter, flow, pump, rotary valve, network, power and external module.
5. A remotely mounted Display may be optionally equipped with 7 or 12 configurable relays for signaling alarm and fault conditions.
6. A single mechanical button to support RESET and DISABLE commands.
7. A touch screen interface to allow scrolling through status screens on the LCD.

4.5 Monitoring

The system shall be supported by software for the purpose of monitoring all devices connected to it. Such software shall be provided to run on:

1. PC-based hardware
2. Android-based hardware
3. iOS-based hardware
4. A dedicated monitoring device built into a detector
5. A dedicated monitoring device mounted remotely from any detector

4.6 Configuration

4.6.1 Configuration Software Tools

The system shall be supported by software for the purpose of commissioning and configuring all parts of the system. Such software shall be provided to run on:

1. PC-based hardware
2. A dedicated monitoring device built into a detector
3. A dedicated monitoring device mounted remotely from any detector

4.7 Programming Device

Programming may be performed using a Windows® application running on a PC connected through a High Level Interfacing unit or by direct connection to a detector.

Each Programmer shall support the following features at a minimum:

1. Programming of any device on the VESDAnet system
2. Viewing of the status of any device in the system
3. Adjustment of the alarm thresholds of a nominated detector
4. Adjustment of the alarm delays
5. Setting of Day/Night, weekend and holiday sensitivity threshold settings from the available levels
6. Multi-level password control
7. Programmable latching or non-latching relay operation
8. Programmable energized or de-energized relays for the relays in the detector
9. Programmable high and low flow thresholds settings for airflow supervision
10. Programmable maximum tube length
11. Programmable maintenance intervals

4.8 Security

The following security measures shall be provided:

1. Connectivity via wireless access shall support WPA2 encryption with encryption key.
2. Access to a detector via Ethernet or WiFi shall be protected using a detector password specific to the detector and in addition to the WiFi encryption key.
3. All software connecting to a detector or peripheral shall support an authentication protocol to verify that it has been supplied by the manufacturer of the system.

4.9 Upgrading

There shall be provision for field upgrading the firmware in the system using a USB memory key connected directly to the detector, avoiding the need for a separate PC for this function.

4.10 Peer-to-peer Network Ports

A peer-to-peer networking facility shall be provided for the purposes of reporting alarms, faults and monitoring status, history and for configuration of devices.

The peer-to-peer network shall:

1. Comprise a physical layer that shall:
   - comply with the ANSI/TIA/EIA-485-A-1998 electrical specifications
   - employ asynchronous serial data transfer
   - operate at a baud rate no less than 19.2 kBaud.
   - detect communications errors due to interference, open and short circuit
   - detect ground faults
2. Be able to support up to 200 devices (detectors, displays and programmers), of which 100 detectors can be supported.
3. Be capable of being configured in a fault tolerant loop for both short circuit and open circuit, and ground fault. Any communication faults shall be reported unambiguously and shall be clearly attributable to an individual device or wire link in the fault messages.
4. Be configurable by PC based configuration tools that are available to configure and manage the network of detectors.

4.11 Secondary communications

Detectors shall provide inbuilt secondary communications for monitoring and configuration using the following physical media:

- USB
- 10/100 BaseT Ethernet
- WiFi (802.11b/g)

4.12 Faults

The Detector Fault relay shall be connected to the appropriate fire zone on the Fire Alarm Control Panel (FACP) in such a way that a Detector Fault would register a fault condition on the FACP. The Minor Fault and Isolate relays can also be connected to the appropriate control system.

Check local Codes, Standards or Regulations to determine whether compliance with this set up is required.

4.13 Power Supply and Batteries

The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Typically 24 hours standby battery backup is required followed by 30 minutes in an alarm condition.

Local Power Supply Standards that may apply:

1. UL 1481 Listed - provided the power supply and standby batteries have been appropriately sized / rated to accommodate the system’s power requirements.
2. US Telecommunication Central Office Power Supply- the system shall operate on negative 48 VDC (provided continuously from the telephone central office power source) converted to 24VDC.
3. EN 54-4 approved power supply for use in Europe.
4. In accordance with AS 1670.1 and NZS4512 – latest editions.

4.14 Environmental

The detector shall:

1. Have an IP40 rated enclosure.
2. Operate at an ambient temperature range of at least 0°C to 39°C (32 to 103 °F) at a relative humidity of 10-95% (non-condensing).
3. Be able to sample air with a temperature ranging from -20°C to 60°C (-4 to 140 °F).

4.15 Microbore Tubes

1. 6mm (0.24”) OD / 4mm (0.16”) ID and 4mm (0.16”) OD / 2.5mm (0.1”) ID tubes shall be used.
2. Tubes shall have adequate marking to meet local codes and standards.
3. Tubes shall be UL listed / recognized.
4. Tubes shall be approved for use in the protected environment.
5. Maximum tube length shall be up to 100m (328ft), however shorter tube lengths may be accommodated in accordance with the manufacturer’s guidelines.

5 Installation

5.1 The Detection System

The contractor shall install the system in accordance with the manufacturer's System Design Manual. The installers must be accredited by the manufacturer.

5.2 Mounting

The detector shall be capable of mounting directly to a wall using screw fasteners or by using a stainless steel mounting bracket.

5.3 The Sampling Tube Network

The sampling tube network shall comply with the following requirements:

1. Where false ceilings are installed, the sampling tubes shall be installed above the ceiling, and sampling points shall be installed on the ceiling and connected to the sampling tube.
2. The sampling tubes shall be of the same length or use the manufacturer’s guidelines to run tubes of the required lengths using two diameter tubes (6mm (0.24”) and 4mm (0.16”) OD).

5.4 Transport Time

Wherever possible the transport time (i.e. the time taken by smoke sampled to register at the detector) from the least favorable sampling point shall meet local code requirements.

Longer transport times may be tolerated where longer tube runs are required and where local codes and standards permit.

6 System Commissioning

6.1 Detector commissioning

The detector shall incorporate a push button to invoke self-learning modes to simplify commissioning including:

1. A learning mode that determines the reference flow (normalized flow) based on environmentally induced flow changes during the commissioning process.
2. Additionally, there shall be provision for a PC software tool to configure all user modifiable parameters of the all system devices.

6.2 Commissioning Tests

All necessary instrumentation, equipment, materials and labour shall be provided by the Contractor.

The Contractor shall record all tests and system configuration to establish “Baseline Data” and a copy of these results shall be retained on site in the System Log Book as a part of required system documentation.

6.3 System Checks

1. Visually check all sampling tubes and sampling points to ensure that layout complies with the specification.
2. Connect power.
3. Connect VSC to USB / Ethernet port as per instructions in the product guide.
4. Wait 15 minutes for pump to warm up.
5. In Xtralis VSC configure the number of sampling tubes in use and maximum tube length.
6. Execute Normalization via Xtralis VSC. Note the detector will not normalize until 15 minutes after power up.
7. Execute sample point test, which tests the presence of the sampling point.
8. Check the detector to ensure the following features are operational and programmed in accordance with the specification:
   - Alarm threshold levels
   - Time delays
   - Sampling tubes in use
   - Detector address
   - Display address
   - Clock time and date
   - Air flow fault thresholds
   - Reset button operable
   - Touch screen operable where installed
   - Units set to U.S./S.I. (for US only) or metric for other regions
   - Check to ensure that all ancillary warning devices operate as specified.
9. Check interconnection with the fire alarm panel to ensure correct operation by executing the Alarm Test, which checks all relay connections to the fire alarm panel.

6.4 Final Tests

The contractor shall:

1. Place the detector in Smoke Test mode and measure the transport times by putting smoke in each sampling hole and by checking the transport times
2. Activate the appropriate Fire Alarm zones and advise all concerned that the system is fully operational.
3. Fill out the logbook and commissioning report accordingly.

7 Maintenance

Detector maintenance shall be carried out at stipulated intervals and as per local maintenance standards.

7.1 Sample Filter

1. The detector shall incorporate a filter with replaceable filter to remove large contaminants from the sampled air.
2. The filter shall be accessible by opening and removing the front cover.
3. Once accessible, the filter shall be removable and replaceable with the aid of a tool.

7.2 Centralised Smoke Test

1. The detector shall incorporate a centralised smoke test facility to test the operation of smoke sensor module.
2. Place the detector in Centralise Smoke Test mode and perform a smoke test to ensure that smoke sensor module detects smoke.

7.3 Tube Integrity Test

1. The detector shall incorporate a test facility to test the microbore tube integrity and sampling point integrity, this is required after rectifying microbore tube or sampling point related faults.
2. Place the detector in Tube Integrity Test mode and select the sampling tubes to be tested and run the test – this may be required after rectifying sampling tube related faults.

www.acornfiresecurity.com